



UNIVERSITY OF MAINE AT FARMINGTON
COLLEGE OF EDUCATION, HEALTH AND REHABILITATION

LESSON PLAN FORMAT

Teacher's Name: Sarah Fredrick **Lesson #:** 2 **Facet:** Application

Grade Level: High School **Numbers of Days:** 2-3

Topic: Probability and Problem Solving

PART I:

Objectives

Student will understand that probability is useful in problem solving and decision making

Student will know Definitions - probability, expected value, probability distribution, random variable, mean, median, standard deviation, standard error, Formulas - expected value formula, probability distribution formula, z-value formula for means, z-value formula for probability, Critical details - problem solving

Student will be able to solve a problem using probability

Product: Google Docs

Maine Learning Results (MLR) or Common Core State Standards (CCSS) or Next Generation

Science Standards (NGSS) Alignment

Common Core State Standards

Content Area: Statistics and Probability

Grade Level: High School

Domain: Using Probability to Make Decisions

Cluster: Calculate expected values and use them to solve problems

Standards: 4. *Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value.*

Rationale: This standard will be met in this lesson because the teacher will be teaching students how to develop a probability distribution and find the expected value and solve problems using the expected value.

Assessments

Formative (Assessment for Learning)

Section I – checking for understanding strategy during instruction

The teacher will put different probability problems on the board and a student from each team will come up to the board and slap the answer if the team knows the answer.

Section II – timely feedback for products (self, peer, teacher)

Students will use a checklist to make sure they have all the components in the problem they created. As the teacher I will look through the problems that students created and I will give written feedback on a checklist.

Summative (Assessment of Learning):

Google Docs: Students will create their own "beefy" problem that can be solved using probability. They must also make an answer sheet for their problem. Students will share the problem they have created with their classmates and the teacher on Google Docs. Students will then look at the problems that their classmates have created and will solve them using probability. Students will email their answer sheets to the teacher. All the problems that students have created will be gone over in class with the student leading

the rest of the class through the problem that they created to get the answer. 40 points

Integration

Technology (SAMR):

Students will create a problem that can be solved using probability and will post it on google docs and share with the teacher and their classmates. This is at the augmentation level because students can come on each other's problems and solve the problems on the google doc. More than one student can be typing on the page at a time.

Content Areas:

English. Students will be creating their own word problems and are expected to have proper grammar and sentence structure in their questions.

Groupings

Section I - Graphic Organizer & Cooperative Learning used during instruction

Types of Questions T-chart- students will see different problems that can be solved using probability. Using the chart they will classify the problems as beefy problems or bony problems which will help them when they create their own problem. Pairs check - I will write a question on the board. One student will coach the other through the problem, they will then switch and I will give them a new problem.

Section II – Groups and Roles for Product

Students will be working both alone and with the class to create their own problems. Students will create their own problems but they will be solving the problems that their classmates created.

Differentiated Instruction

MI Strategies

Verbal: Students will be talking in their groups about the answer to the question during Slap It.

Logic: Students will think about the two types of questions and will use their understandings to create their own problem that can be solved using probability.

Visual: Some of the questions during the Slap It activity will have graphs.

Musical: The probability song will be played in the beginning of the lesson to remind students what type of problems are solved with probability.

Kinesthetic: Students will be getting up and moving around when they are playing Slap it.

Intrapersonal: Students will be making their own problem and will be assessing their work using a checklist.

Interpersonal: Students will be working in two teams during Slap It.

Naturalist: Some of the problems that are solved in this lesson using probability will deal with gardening and nature.

Modifications/Accommodations

From IEP's (Individual Education Plan), 504's, ELLIDEP (English Language Learning Instructional Delivery Education Plan) I will review student's IEP, 504 or ELLIDEP and make appropriate modifications and accommodations.

Plan for accommodating absent students:

If you are absent, it is the student's responsibility to make up the assignments and/or tests when they return. All homework assignments are posted on my class website. This includes classes missed for field trips and sports events. It is the student's responsibility to come in at lunch or after school to catch up on missed work from their absences. You should get the notes that you missed from another student before meeting with me. If students are absent on the day of a test, they will be expected to make up the test on the next day that they are in school. There are exceptions for extended absences but the student must come see me the day they get back to school. Students will be expected to get notes from classmates and come in to see the teacher afterwards if they miss any day during this lesson. If students miss the day that

the project is introduced they will be expected to come and see the teacher to talk about an extension. If students miss the entire time that the project is being worked on then they will need to see the teacher for an extension.

Extensions

Technology (SAMR): Gifted Students:

The google docs project can be brought to the modification level by students sharing the problem they have created with other classes and other teachers.

Materials, Resources and Technology

Print outs of the [graphic organizers](#)

fly swatters

colored note cards

laptops

white board and markers

checklists

Source for Lesson Plan and Research

<http://dictionary.reference.com/browse/probability> probability definition.

<http://www.investopedia.com/terms/e/expected-value.asp> expected value definition

<http://www.investopedia.com/terms/p/probabilitydistribution.asp> probability distribution definition

https://en.wikipedia.org/wiki/Random_variable random variable definition

<https://en.wikipedia.org/wiki/Mean> definition of mean

<https://en.wikipedia.org/wiki/Median> definition of median

https://en.wikipedia.org/wiki/Standard_deviation definition of standard deviation

<http://www.investopedia.com/terms/s/standard-error.asp> definition of standard error

<http://statistics.about.com/od/Formulas/a/What-Is-The-Formula-For-Expected-Value.htm> expected value formula

<http://formulas.tutorvista.com/math/probability-distribution-formula.html> probability distribution formula

<http://www.statisticshowto.com/how-to-calculate-a-z-score/#zscoreformulas> z - value formula for means

<https://people.richland.edu/james/lecture/m170/ch08-pro.html> z- value formula for proportions

http://edu221resources.wikispaces.com/file/view/cooperative_learning_strategies.pdf/426402320/cooperative_learning_strategies.pdf. The teacher will use the Pairs check activity from this website as a cooperative learning strategy.

<https://www.youtube.com/watch?v=0xm1SDlnvh4>. The teacher will use this song on YouTube in the beginning of the lesson before the hook.

<http://edu221spring11class.wikispaces.com/file/view/strategies.pdf/200849872/strategies.pdf> List of checking for understanding strategies.

http://www2.sunysuffolk.edu/pestiej/MAT125_review_questions.pdf the teacher will use some of the questions on the quiz hook.

<http://myteacherpages.com/webpages/RSlobodnik/files/Precalculus%20Final%20Review.pdf> the teacher will use some of these questions in the hook

https://www.khanacademy.org/math/probability/statistics-inferential/normal_distribution/v/ck12-org-normal-distribution-problems-z-score. The teacher will use this as a resource when making the homework packet and when creating problems to do in class.

https://www.khanacademy.org/math/probability/statistics-inferential/normal_distribution/e/z_scores_1 the teacher will use this as a resource when making the homework packet and when creating problems to do in class.

https://www.khanacademy.org/math/probability/statistics-inferential/normal_distribution/v/ck12-org-

[more-empirical-rule-and-z-score-practice](#) the teacher will use this as a resource when making the homework packet and when creating problems to do in class.

<https://www.youtube.com/watch?v=i0P-i9gD--c>. A tutorial on how to share google docs with others and allow them to edit.

<https://support.google.com/docs/answer/2494822?hl=en> tutorial on Google Docs

<http://edu221resources.wikispaces.com/file/view/excellent-book-of-graphic-organizers.pdf/513945384/excellent-book-of-graphic-organizers.pdf>. Types of questions T-chart graphic organizer

PART II:

Teaching and Learning Sequence

Classroom Arrangement

The classroom will have three rows made up of two desks pushed together. The desks will be facing the board. There will be a table with lined paper and other supplies that the students may need for the lesson

Agenda

Day 1: Hook as introduction to the lesson (20 minutes)

Learning how to solve word problems using probability and expected value. (50 minutes)

Talking about the difference between "bony" problems and "beefy" problems (10 minutes)

Assignment: Packet of Probability Problems

Day 2: Going over any questions on the homework problems using [Pairs Check](#). (15 minutes)

Examples of both types of problems and noting the difference between them. (40 minutes)

Introduction to Google Docs project (10 minutes)

Time to work on creating your own problem (15 minutes)

Assignment: Have a rough draft of problem for the next class

Day 3: Practice problems using probability by playing [slap it](#). (30 minutes)

Time for peer feedback on rough draft of problems. (20 minutes)

Time to make changes on problem and start creating an answer sheet (15 minutes)

[Tutorial](#) for using Google Docs and sharing it with the teacher and classmates (15 minutes)

Assignment: Post problems on Google Docs and share with classmates and teacher by 7 PM tonight.

Email or share answer sheet to your problem to the teacher. All students must show work for the problems they solved on a separate sheet of paper, bring this paper to our next meeting. DO NOT post work on the Google doc.

Teaching and Learning Sequence

Students will understand that probability is useful in problem solving and decision making. The standard that will be addressed in this lesson is 4. *Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value.* The teacher will hook the students into the lesson by giving them a short test on a subject other than probability. The students will look over the test and be asked to guess on the questions to see how many they can get right by guessing. Students will record the number of questions that they got right by guessing. Using this data the teacher and the students will construct a probability distribution and expected value. The expected value will tell students how many answers they are expected to get correct by guessing. This activity will show students how to set up problems and how the problems that occurring in this lesson can be connected to the real world. The teacher will then create a problem using the data that was collected in class to teach students how to set up probability problems and how to solve them. This will hook students into the lesson because a lot of students calculate how many questions they don't know and see what grade they will get based on what they don't know and what they guess on.

Where, Why , What, Hook Tailors: *Intrapersonal, Interpersonal*

Students will know **probability** - the possibility that an event will occur, **expected value** - the predicted value for a given event, **probability distribution** - describes all the possible values and their likelihood of occurring, **random variable** - a variable whose value is subject to variations due to chance, **mean** - used as a synonym for expected value, **median** - the number that separates the higher half of the data sample from the lower half, **standard deviation** - the number that is used to describe how much the data varies from the mean, **standard error** - the standard deviation of the sampling distribution, **expected value formula** - $E(X) = x_1p_1 + x_2p_2 + x_3p_3 + \dots + x_npn.$, **z-value formula for means** - $z = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}}$, **z-value formula for**

$$z = \frac{\hat{p} - p}{\sqrt{\frac{pq}{n}}}$$

$$P(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$$

probability - , **probability distribution formula** - , problem solving. (see content notes) During this lesson the teacher will hand out **T-chart graphic organizers**. Students will use this T- chart to compare two types of word problems, "beefy" problems and "bony" problems. Students will fill out the graphic organizer in class when the class goes over the difference between the two types of word problems. Students will also use the graphic organizer when they create their own word problems because the goal is for the students to create "beefy" problems. The students will use the graphic organizers when they are looking over their classmates' problems in class to give suggestions on how they can turn their problem into a "beefy" word problem. The **checking for understanding activity** in this lesson is **Slap it**. By using this activity the teacher can make sure that students know how to solve probability problems. The teacher will have a question on the board. There will be different categories for that question, such as technical conditions, answer, graph, etc. The students will choose one of the categories. For each category there will be multiple answers. Students will have to slap the correct answer using a fly swatter. After each slap the teacher will make sure that students understand why that is the correct answer. The **cooperative learning activity** that will be used in this lesson is **Pairs check**. The teacher will use this activity by going over the homework problems. Students will be in pairs and one partner will coach the other partner through the problem. The teacher will move on to the next problem and the pairs will switch.

Equip, Explore, Rethink, Tailors: *Interpersonal, Intrapersonal, Visual, Verbal, Logical, Kinesthetic*

Student will be able to solve a problem using probability In this lesson students will be creating one product using Google Docs. Students will be working by themselves to create the final product. The teacher will use the **tutorials** during the class time that has been set aside to introduce the project. Students will be shown where they can find the links on the teacher's website this way they can use them outside of class. Students will have the opportunity for peer feedback during this project during the time set aside in class. Students will be looking at their **graphic organizers** and will be helping their classmates turn their problems into "beefy" word problems instead of "bony" word problems. Students will also be self-assessing their work using a checklist that is provided by the teacher. The students will self-assess their work using the same checklist that the teacher will use to grade their products. Students will be allowed to revise their products based on the feedback that they receive in class from their peers. Students will also be allowed to refine their work after receiving feedback from the teacher.

Experience, Revise, Refine, Tailors: *Interpersonal, Intrapersonal, Logic, Naturalistic*

The teacher will give feedback on the product. The teacher will use a checklist for the Google Docs project. The teacher will use the checklist to see if students have the important components in their products. The teacher will provide written feedback on the checklist so that students know why one of things wasn't checked off as well as written feedback that explains their grade. The teacher will have the checklist when looking at the problems students posted on Google Docs and as well as the answer key.

The teacher will use the checklist when looking at students work and their comments on each other's products. The teacher will do this as the students share the products to the teacher and as students comment on their classmates problems. The teacher will look at the work students hand in before the next class meeting. Knowing how to solve problems using probability and knowing how to create their own problems will help students when they look at where probability is in their lives and when creating the performance task.

Evaluate, Tailors: *Intrapersonal, Visual, Logic, Verbal*

Teacher Content Notes

Day 1: The teacher will start the lesson by playing the [probability song](#) to remind students of what they will be learning throughout the unit. The teacher will then have students take a multiple choice test that has nothing to do with what they have been learning. The students will be told to guess on the questions that they don't know. Students will be given 15 minutes for this activity. The teacher will then go over the answers to the test and have students mark which ones they got correct. The teacher will then collect the number of questions they got right. Using this data the teacher and the students will construct a probability distribution and expected value. The expected value will tell students how many answers they are expected to get correct by guessing. This activity will show students how to set up problems and how the problems that occurring in this lesson can be connected to the real world. The teacher will then create a problem using the data that was collected in class to teach students how to set up probability problems and how to solve them. The teacher will go through how to set up a few additional problems. Z-value calculations will be introduced in this lesson. Students will know how to find z- scores for [means](#) and [proportions](#). During the set up the teacher will be explaining the technical conditions that must be met in order to solve the problem. The class will then be given the [T-chart graphic organizer](#). The class will then talk about the difference between "beefy" and "bony" problems. The students will be given a packet of 10 problems for homework. Students should be looking at the problems to see if they are considered "beefy" or "bony". Students will start the packet in class, whatever they don't finish will be homework.

Day 2: The teacher will start class by going over questions in the homework packet. The teacher will clear up anything that was unclear in the problems by using a [pairs check](#). Students will be in pairs and one partner will coach the other partner through the problem. The teacher will move on to the next problem and the pairs will switch. The class will then have a discussion on which problems they thought were "beefy" and which ones were "bony". The class will then determine the characteristics of each type of problem. After this discussion the teacher will explain the Google docs projects that students will begin to working on in class. The students will have time at the end of class to work on starting to create their own probability problems. Students will need to have a rough draft of a problem for the next class. The rough drafts can be "bony" problems since they will work on turning them into "beefy" problems next class.

Day 3: The teacher will start the class by playing the [checking for understanding game slap it](#). By using this activity the teacher can make sure that students know how to solve probability problems. The teacher will have a question on the board. There will be different categories for that question, such as technical conditions, answer, graph, etc. The students will choose one of the categories. For each category there will be multiple answers. Students will have to slap the correct answer using a fly swatter. After each slap the teacher will make sure that students understand why that is the correct answer. After the activity students will be asked to share their rough drafts with partners and get feedback on how they can make the problem "beefy" instead of "bony". This is also give students the opportunity to tell their classmates if any part of their problem is confusing or unclear. Students will then be given time to make corrections or notes on their problems and to start making an answer sheet. In the last 15 minutes of class the teacher will go over the Google Docs aspect of the project. The teacher will show students how to share the problems with their classmates and the teacher. The teacher will do this by showing the [tutorial](#) to the class and by showing them where the [tutorial](#) can be found on the teacher's website for future reference. For homework students will post their problems on Google Docs and share the problem and the question

with the teacher by 7 PM tonight. The students must also share the answer sheet to their problems with the teacher by 7 PM. Since class meets every other day the students will have the next night to solve the problems their classmates have created. (See above agenda for more assignment details)

Handouts

t-chart graphic organizer

checklist

homework packets

Maine Common Core Teaching Standards for Initial Teacher Certification and Rationale

Standard 1 – Learner Development. The teacher understands how learners grow and develop, recognizing that patterns of learning and development vary individually within and across the cognitive, linguistic, social, emotional, and physical areas, and designs and implements developmentally appropriate and challenging learning experiences.

Learning Styles

Clipboard: The teacher will hand out a graphic organizer where students will compare the two types of word problems, "bony" and "beefy". This is help the clipboard students organize their thoughts and will help them when they create their own problem that can be solved using probability.

Microscope: Students will be discussing how they can "beef up" their problems with their classmates.

Puppy: The teacher will make sure that students feel safe in the classroom environment. The teacher will also make sure that students feel comfortable enough to be able to share the problems they created with their classmates without getting negative comments.

Beach Ball: Students will have personal freedom when creating their own probability problems. The problems can be about any data that students find interesting as long as it can be solved with probability and it is reasonable. I.e. no outlandish data or problems that don't have any data in the real world.

Rationale: It is important for the teacher to address all of these learning styles because in the classroom teachers will have students with each learning style and all the students need to be able to learn in a way that best suits them.

Standard 6 - Assessment. The teacher understands and uses multiple methods of assessment to engage learners in their on growth, to monitor learner progress, and to guide the teacher's and learner's decision making.

Formative:

Slap it - The teacher will put different probability problems on the board and a student from each team will come up to the board and slap the answer if the team knows the answer.

Summative:

Google Docs: Students will create their own "beefy" problem that can be solved using probability. They must also make an answer sheet for their problem. Students will share the problem they have created with their classmates and the teacher on Google Docs. Students will then look at the problems that their classmates have created and will solve them using probability. Students will email their answer sheets to the teacher. All the problems that students have created will be gone over in class with the student leading the rest of the class through the problem that they created to get the answer.

Rationale: I am using the formative assessments to make sure that students know how to set up problems, what the graphs for those problems look like and how to find the answer to those problems. The

summative assessment will show the teacher that students mastered how to solve problems using probability and that they understand what makes up a good question since they will be creating their own.

Standard 7 - Planning Instruction. *The teacher plans instruction that supports every student in meeting rigorous learning goals by drawing upon knowledge of content areas, curriculum, cross-disciplinary skills, and pedagogy, as well as knowledge of learners and the community context.*

Content Knowledge:

Students will know **probability** - the possibility that an event will occur, **expected value** - the predicted value for a given event, **probability distribution** - describes all the possible values and their likelihood of occurring, **random variable** - a variable whose value is subject to variations due to chance, **mean** - used as a synonym for expected value, **median** - the number that separates the higher half of the data sample from the lower half, **standard deviation** - the number that is used to describe how much the data varies from the mean, **standard error** - the standard deviation of the sampling distribution, **expected value formula** - $E(X) = x_1p_1 + x_2p_2 + x_3p_3 + \dots + x_n p_n$, **z-value formula for means** -

$$z = \frac{\hat{p} - p}{\sqrt{\frac{pq}{n}}}$$

z = x - μ / σ, z-value formula for probability -

$$P(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$$

, problem solving

,probability distribution formula -

MLR or CCSS or NGSS

Common Core State Standards

Content Area: Statistics and Probability

Grade Level: High School

Domain: Using Probability to Make Decisions

Cluster: Calculate expected values and use them to solve problems

Standards: 4. Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value.

Facet: Application

Rationale: I choose this standard because the teacher will be teaching students how to solve problems and how to create their own problems. By creating their own problems students are developing probability distributions for random variables and are finding the expected value.

Standard 8 - Instructional Strategies. *The teacher understands and uses a variety of instructional strategies to encourage learners to develop deep understanding of content areas and their connections, and to build skills to apply knowledge in meaningful ways.*

MI Strategies:

Verbal: Students will be talking in their groups about the answer to the question during Slap It.

Logic: Students will think about the two types of questions and will use their understandings to create their own problem that can be solved using probability.

Visual: Some of the questions during the Slap It activity will have graphs.

Musical: The probability song will be played in the beginning of the lesson to remind students what type of problems are solved with probability.

Kinesthetic: Students will be getting up and moving around when they are playing Slap it.

Intrapersonal: Students will be making their own problem and will be assessing their work using a checklist.

Interpersonal: Students will be working in two teams during Slap It.

Naturalist: Some of the problems that are solved in this lesson using probability will deal with gardening and nature.

SAMR:

Students will create a problem that can be solved using probability and will post it on google docs and share with the teacher and their classmates. This is at the augmentation level because students can come on each other's problems and solve the problems on the google doc. More than one student can be typing on the page at a time.

Rationale:

The MI's that are being used in this lesson are differentiating instruction because they are helping students with different learning styles be successful in this class. By satisfying multiple intelligences, the teacher is giving all students an equal opportunity to learn no matter what intelligence they learn best in. The Google Docs project is promoting higher level thinking because students are thinking about what makes up a good problem and are thinking about how to create a problem that can be solved using probability.

NETS STANDARDS FOR TEACHERS

1. Facilitates and Inspire Student Learning and Creativity. Teachers use their knowledge of subject matter, teaching and learning, and technology to facilitate experiences that advance student learning, creativity, and innovation in both face-to-face and virtual environments.

a. Promote, support, and model creative and innovative thinking and inventiveness

b. Engage students in exploring real-world issues and solving authentic problems using digital tools and resources

c. Promote student reflection using collaborative tools to reveal and clarify students' conceptual understanding and thinking, planning, and creative processes

d. Model collaborative knowledge construction by engaging in learning with students, colleagues, and others in face-to-face and virtual environments

Rationale: a, b, c. The teacher will be addressing standard a and b by requiring students to create their own real-world problems. Students will reflect on the problems they have created by getting peer feedback and by comparing their problems to the criteria for a "beefy" problem and reflecting on whether or not the problem they created can be classified as a "beefy" problem.

2. Design and Develop Digital Age Learning Experiences and Assessments. Teachers design, develop, and evaluate authentic learning experiences and assessment incorporating contemporary tools and resources to maximize content learning in context and to develop knowledge, skills, and attitudes identified in the NETS-S.

a. Design or adapt relevant learning experiences that incorporate digital tools and resources to promote student learning and creativity

b. Develop technology-enriched learning environments that enable all students to pursue their individual curiosities and become active participants in setting their own educational goals, managing their own learning, and assessing their own progress

c. Customize and personalize learning activities to address students' diverse learning styles, working

strategies, and abilities using digital tools and resources

d. Provide students with multiple and varied formative and summative assessments aligned with content and technology standards and use resulting data to inform learning and teaching

Rationale: a, c, d. Students will be using digital tools for their summative assessments in this lesson. The teacher will be using different learning styles throughout the lesson and in the products that students are creating.